Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

SHORTER ARTICLES AND DISCUSSION

INHERITANCE OF COLOR IN THE ALEURONE CELLS OF MAIZE

IN those plants of which there is a considerable knowledge of the heredity of flower sap color, namely, *Antirrhinum, Lathyrus, Matthiola* and *Primula,* it has been found that an hypostatic color factor is often necessary for the production of an epistatic color. For example, a basic factor generally designated as C being present, a flower becomes red by the addition of a factor R, and becomes magenta or purple by the addition of still another factor P. The zygotic formula of a pure red flower is $RRCC$ and of a pure purple flower is $PPRRCC$; but a flower with the zygotic formula $PPCC$ is colorless.

On the other hand, certain seed coat and other colors of wheat, of beans and of other plants do not need the presence of the hypostatic factor for the formation of the epistatic color. For example, Nillson-Ehle crossed a black glumed oat $BBGG$ with a white glumed oat $bbgg$. In the F_2 he obtained 12 black: 3 gray: 1 white. The actual ratio was $9BG : 3Bg : 3bG : 1bg$, but as the black was produced whether the gray factor was present or not, the visible ratio was as given above.

The natural conclusion is that in the first category the epistatic factor is more specific in its action than it is in the second category. If one accepts the interpretation that color is formed by the action of an enzyme on a colorless chromogen, he must conclude that the epistatic enzyme of the first kind can only produce its action, if, by the presence of the hypostatic enzyme, the chromogen has already been carried through a necessary preliminary reaction. An epistatic enzyme of the second kind, however, is sufficient unto itself and is absolutely independent of the action of the hypostatic enzyme. One may even assume that the chemical bases upon which the two enzymes of the second category act are independent of one another.

Perhaps a concrete illustration will show the difference of action in these two cases better than description. In the black glumed oat $BBGG$, one can imagine the black color or the gray color wiped out mechanically. The other color remains. In the purple flower *PPRRCC,* if the red factor is wiped out no color is left.

In an earlier paper East and Hayes[1] found four independent gametic factors in maize, each of which affects the production of color in the aleurone cells of maize. These four factors are a basic color factor *C,* a reddening factor *R,* a purpling factor *P,* and an inhibiting factor *I* which prevents the development either of the red or of the purple color. Of the various points of interest in the interpetation of the inheritance of these factors, two have been investigated further. The first is the cause of modified colors. This will be discussed at length in another paper. The second is the action of the reddening factor *R* and the purpling factor *P*. It was then thought that the presence of the factor *P* together with *C* was all that was necessary for the production of the purple color. It can now be shown that the purple color develops only when the three factors *P, R* and *C* are present. The production of color in the aleurone cells of maize is therefore analogous to that in the flowers of the genera described above, which was designated as category one. This interpretation of the facts makes little difference in the general behavior of these colors in inheritance and is only interesting in so far as it unifies the interpretation of the aleurone colors in maize with the sap colors of certain flowers.

The following scheme will show the differences in behavior in the two schemes.

1. A purple crossed with a non-purple gives 3 purple : 1 non-purple in F_2. Here there is no difference in the two schemes. The proper interpretation gives this result from crosses

PPRRCC × *PPRRcc* or
PPRRCC × *PPrrCC*.

2. A purple crossed with a non-purple gives 9 purple : 7 non-purple in F_2. The old interpretation was that this occurs when the F_1 has the formula *PpCc*. The present interpretation is that it occurs when the formula of the F_1 is *PPRrCc*.

3. A purple crossed with a non-purple gives the formula *PpRrCc* in F_1. If the *R* factor is unnecessary for the production of purple, the ratio in F_2 will be (*a*) 36 purple : 9 red : 19 white. If *R* is necessary for the production of purple the ratio in F_2 will be (*b*) 27 purple : 9 red : 28 white. A sample

---

[1] "Inheritance in Maize," *Conn. Agr. Exp. Sta. Bull.*, 167: 1–141, 1911

family of F_2 segregates gave the following ratio which may be compared with the closest possible expectancy under each theory.

Actual result .... 191 purple : 56 red : 180 white.
Theory (*a*) .... 240 purple : 60 red : 127 white.
Theory (*b*) .... 180 purple : 60 red : 187 white.

This suggests theory *B*, but is not conclusive. Conclusive evidence comes from the F_3 generation. On theory *A*, every 36 purple F_2 seeds should give on the average the following results in F_3:

4 ears all purple.
10 ears segregating 3 purple : 1 white.
4 ears segregating 9 purple : 7 white.
2 ears segregating 3 purple : 1 red.
4 ears segregating 12 purple : 3 red : 1 white.
4 ears segregating 9 purple : 3 red : 4 white.
8 ears segregating 36 purple : 9 red : 19 white.

On theory *B*, every 27 purple F_2 seeds should give on the average these results in F_3:

1 ear all purple.
4 ears segregating 3 purple : 1 white.
2 ears segregating 3 purple : 1 red.
4 ears segregating 9 purple : 7 white.
8 ears segregating 9 purple : 3 red : 4 white.
8 ears segregating 27 purple : 9 red : 28 white.

The crucial test is the appearance of families showing the ratio 12 purple : 3 red : 1 white. No such family has ever appeared. On the other hand they did divide nicely into families with ratios of 9:3:4 and 27:9:28. Of the first type the total progeny of nine families was 935 purple: 318 red: 436 white. The closest theoretical ratio on the basis of 9:3:4 would be 950 purple : 317 red : 422 white. Of the second type the total progeny of four families was 423 purple : 127 red : 396 white. The closest possible ratio on the basis of 27:9:28 would be 400 purple : 133 red : 414 white.

All other tests made corroborated the interpretation that the *P* factor can produce purple only when *R* and *C* are present.

E. M. East

Laboratory of Genetics,
Bussey Institution of Harvard University